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The Effect of an Open-Ended Approach on Students' Creativity in Fractional Material

Ainul Marhamah Hasibuan^{a*}, Edy surya^b

^{a,b} *Mathematics Education of Postgraduate School, State University of Medan, Jl. Willem Iskandar Pasar V, Medan 20221, Indonesia*

^a *Email: ainulmarhamahsb@gmail.com*

^b *Email: edy_surya71@yahoo.com*

Abstract

This research purposed to see whether there was the effect of learning by using *open-ended* approach on students' creativity of mathematics aspect. This research was experiment quantitative research. The Population of the research was students of grade III SD Negeri 200117 and for the sample was students at grade III-C. The instrument of collecting data was the test that given twice, that was a test before being treated and a test after being treated. The research method was quasi experiment. The technique of data analysis was using the formula "t" test. Based on the result of hypothesis test, the everage of pretest result was 51.08 and the everage of posttest result was 78.78. Likewise, theresult of test "T" was obtained $t_{\text{count}} > t_{\text{table}} = 11.67 > 2.042$ with a significant level 5% (0.05) and $df = (N-1) = (31-1) = 30$. So, we could be concluded that there was a significant effect of an open-ended approach on students' creativity in fractional material.

Keywords: Effect; Open-Ended approach; Creativity.

* Corresponding author.

1. Introduction

Education is also an inseparable matter from human's life. It holds an important element for shaping the mindset, morals and human's behavior in order to conform to the prevailing norms, such as religion norms, moral norms, modesty norms, and legal norms based [1] on National Education System which states that: "Education is a conscious and well-planned effort to create a learning atmosphere and learning process so that the students actively develop their potential to have a spritual of religious strenght, a self-control, a personality, an intelligence, a noble character, as well as skills needed by them, society, nation and state."

Mathematics is one of the basic education which is also the quintessence of science or the mother of science. It is a source of other brances of science. In other words, there are lots of the sciences that discovery and development depend on mathematics. It is also a tool in the service of both theoretical interest and practical interest as the application of mathematics [2].

In mathematics, each new abstract concept is understood by the students, it needs to give reinforcement, in order to settle and survive in the students' memory [3]. Ways and approaches in learning mathematics are extremely influenced by the teacher's view of math and the students in learning. In Ariyadi Wijaya's book, Adams and Hamm said, There are four kinds of views about the position and role of mathematics [4], namely:

- Mathematics is a way to think.
- Mathematics is as a comprehension of patterns and connections.
- Mathematics is a tool.
- Mathematics is a language or a tool of communication.

In Mathematics learning at elementary school, reinvention is expected. It is finding an informal solution in the classroom. Alhought the invention is simple and it's not a new thing for people who have known before, but for the elementary students, the discovery is a new thing [3].

Reference [3] Heruman stated in his discovery method, it reveals that in Mathematics learning, the students must find themselves the knowledge they need. In this case, the 'find' means 'discovery, or it can mean as a new invention. Therefore, the presented material to the students is not the last form and it is not informed how to solve it. In this learnining, the teacher has to play more as a guider than as a explainer.

Based on the interview results of the author with the mathematics teacher of SD Negeri 200117 North Padangsidimpuan, so far the teacher has never used the open-ended approach. During the last time the teacher has only used conventional learning model or communicative method and has not varied, because according to the math teacher, using the method was considered as the most effective in order that the students could understand what the teacher explained.

From an introduction that was conducted by the researcher in SD Negeri 200117 North padangsidimpuan at grade IV-C, the researcher saw only a few students who understood the fractional material of mathematics. From in it, the researcher made a test to see how the students' way to solve it. From the result, it clearly showed

that the students were less understanding and students' creativity was still lacking in solving the problem of fractional material. From forty students who followed the test, there were only eleven students who answered correctly and twenty nine students who have not been able to answer it correctly.

Student activity could be obtained when a teacher could choose a compatible learning model with the material, situation, and learning conditions. One of the learning approach alternative that is more oriented on students' activity and students' creativity is the open-ended approach [5].

Open-ended approach is a learning that presents problems with lots of different solutions and the solutions can also be varied. This learning can train and creat creativity ideas, and critical thinking [2].

The goal of open-ended learning is to develop the creative activities and the mathematical thinking skills simultaneously. When a test is given in an open-ended form, so the students have a chance doing exploration of probability solutions (in this case is as a creative activity) by using their mathematical knowledge and skills that they have (in this case is as mathematical thinking skill) [4]. The advantages of the open-ended approach include: [2]:

- The students participate more active in the learning and they often express ideas.
- The students have more opportunities in exploiting the knowledge and mathematics skills comprehensively.
- The students with low mathematics skills can respond on the problem with their own way.
- The students are intrinsically motivated to provide an evidence or an explanation.
- The students have a lot of experience to find something in answering the problem.

The steps of the *open-ended approach* [6], they are :

- Facing the students on opened problem to emphasize how they reach at the solution.
- Guiding the students to find patterns in constructing their own problems.
- Letting the students to solve the problems with various solutions and various answers.
- Asking the students to present their inventions.

The indicators of creativity are:[7].

- The ability to think smoothly, that is, trigger lots of ideas, answers and solve problems or questions, provide lots a lot of ways or suggestions to do some matters and always think more than one answer.
- Flexible thinking skills, that is, produce ideas, varied answers or questions, can see the problem from the different perspectives, and look for lots of different alternatives.
- Original thinking, that is, able in thinking out of new expression and making combinations of parts or elements.
- Detailed Skill, that is, able in enriching and developing a concept and specifying details of a matter, object, idea, or situation so it becomes more interesting.

- Assessing skills, that is, decide the benchmark standards of self-assessment and determine whether a statement is true, a good plan, or a wise action.
- Curiosity, that is, always motivated to know more and more about something.
- Imaginative, that is, able in demonstrating or imagining unhappened things.
- Advancement challenged, that is, always supported by the complex situation.
- Risked courageous, that is, dare to give an answer eventhough uncertain answer.
- Respectful natured, that is, can appreciate guidance and a briefing in the life.

2. Research Method

The population of this research was all students of grade III SD Negeri 200117 and the sample was the students of grade III-C. The sample was taken one class. This research was quasi experiment by using experimental design of One Group Pre Test Post Test Design. One Group Pre Test Post Test Designis performed only on one group without a comparison group. This modelis more perfect than when compared with the first model because it has already used pre test so that the effect of experiment can be known. [8].

T_1 X T_2

Explanation: T_1 = Score of *pre test* (before being treated)

T_2 = Score*post test* (after being the treated).

In this matter, the researcher took a technique of non probability samplingby choosing purposive sampling. Where this purposive sampling of this research was taken with a specific purpose or a specific goal, that someone or something has needed the research information [9].

The Instrument of collecting data in this research was by using essay test. In order that the instrument of math question sheet could be worked optimally, then the first was started with validation by the experts [10].Because this research used test, so test of the validity was rationally.

A test is called to have a rational validity if it has been done analyzing of two terms, they are: content and arrangement/contruction [11].

3. Results and Discussions

3.1 Results of the research

Description of data

a. Description of Pretest (before being treated)

Table 1: The Result of Statistical Data Analysis in Pretest

Total of Classes	Interval	Mean	Median	Modus	Standard of Deviation
6	6	51.08	55.40	55	11.02

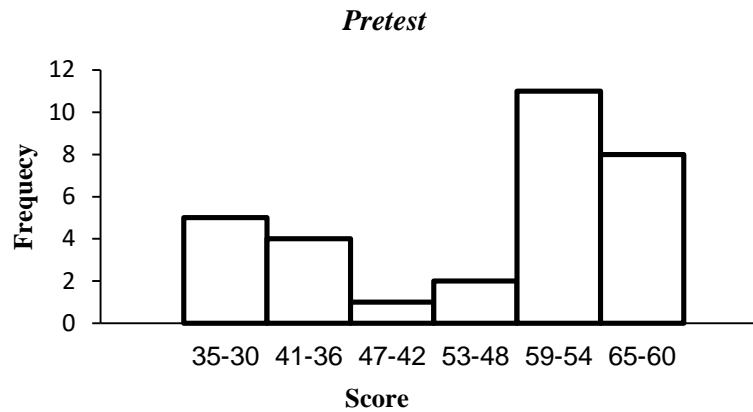


Figure 1: Students' pre test ability

b. Description of post test (after being treated)

Table 2: The result of Statistical Data Analysis in Posttest

Total of classes	Interval	Mean	Median	Modus	Standard of Deviation
6	6	77.01	78.78	88	9.36

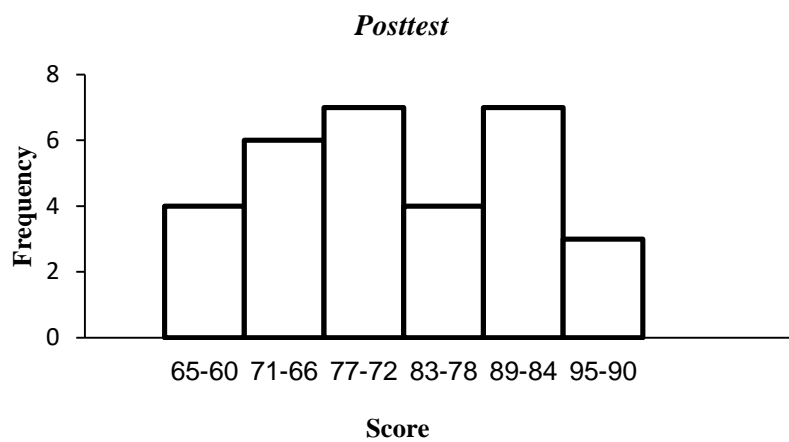


Figure 2: The students' post test ability

Normality test

a. Analysis of pre test

To test normality of the data, it was used the formula of *chi-quadrade*, that is $X^2 = \sum_{i=1}^K \frac{(O_i - E_i)^2}{E_i}$. After the calculation of the pretest result, it was got the value of $X_{count}^2 < X_{table}^2$, it was $7.094 < 7.815$. So, it could be concluded that this sample hypothesis came from the normal distribution.

b. Analysis of post test

To test normality of the data, it was used the formula of *chi-quadrade*, that is $X^2 = \sum_{i=1}^K \frac{(O_i - E_i)^2}{E_i}$. After the calculation of the posttest result, it was got the value of $X_{count}^2 < X_{table}^2$, it was $3.959 < 7.815$. so, it could be concluded that the hypothesis of the sample came from the normal distribution.

c. Hypothesis Test

Based on the calculation result of hypothesis test with the formula of test "t" it was got $t_{count} > t_{table} = 11.67 > 2.042$ with significant level 5% (0.05) and $df = (N-1) = (31 - 1) = 30$. So, it could be got the conclusion of H_0 was refused and H_a was accepted, it meant that there was a significant effect of an open-ended approach on students' creativity in fractional material at grade III SD Negeri 200117 North Padangsidempuan.

3.2 Discussion

Before the treatment was given to the sample class by using an open-ended approach, firstly the pretest was given as an initial of students' condition. After the researcher got the students' pretest result of the fractional material, their scores were still low. So, the next action, the researcher gave a treatment. It was a treatment by using an open-ended approach. After giving it, they were given a posttest to the sample class. The learning process in the sample class was begun by conveying learning objectives as well as as providing an explanation of the open-ended approach that would be used in learning process. Then, the students were given motivation by giving explanation of the importance of learning, especially in the field of mathematics of fractional material.

Then the students were given worksheet (LKS) to develop mathematics thinking individually or in groups. In this case, after students did the questions individually they then shared it in groups. This matter caused lots of ways of completion and correct answers that generated curiosity about how the ways of other students constructed and completed the questions until finding the final solution/final completion. This approach caused them to discuss more, exchange ideas each other even to debate within their group members. Thus, the learning with an open-ended approach was effective on the capability of mathematical problem solving and students' behaviours toward mathematics.

In piaget's theory, it has had a profound impact on the theory and practical education. The first, the theory focused on education ideas appropriate to the stage of development, education with the environment,

curriculum, teaching materials, and teaching that were appropriate for students from their physical and cognitive angle and necessary. The Piaget's theory has influenced on learning model [12].

Vygotsky saw the development of cognition as a continuation of social development through interaction with others and environment. Learning with helps took place in the zone of children proximal development, in which they can perform new tasks in their trays only with the teacher's helps or peer's helps. Children live through the learning, develop independence, and solve problems through loud and silent private conversations. The teacher provided the interaction context, such as learning group together [12].

Based on the research result that has been described on the calculation result, it showed that before and after giving the tests were obtained differences. The average of pretest result was 51.08 and the average of posttest result was 78.78. From the difference of those averages, it was got that before and after being treated by using an open-ended approach on students' creativity was improved. Thus, the test result "t" was obtained $t_{count} > t_{table} = 11.67 > 2.042$ with a significant level 5% (0,05) and $df = (N-1) = (31-1) = 30$. This matter proved that the result of students' learning creativity after being treated was higher than before being treated.

The Specific Findings

From the research [13] that using an open-ended approach; based on validation of the validators, the average of the teacher's book was 8, the average of lesson plans was 8.5, the average of learning management was 7.5. they were called practical; students' activity has fulfilled effective criteria and called practical, students' learning completion reached 80% and it was called effective, the students' responses reached 90% and called effective. Therefore, it could be concluded that the teaching materials by using an open-ended approach in triangle material at grade VII SMP Negeri 6 Pematangsiantar was valid, practical, and effective. For mathematical problem solving skills was improved with a gain presentation 61%.

Based on the data analysis and discussion [5], it could be concluded as following: (1) an open-ended and a contextual approach in mathematics was effective in aspect of mathematical problem solving skills and students' behaviours toward mathematics at grade VIII SMPN 6 Yogyakarta, (2) there was a significant difference of effectiveness in applying of the open-ended and contextual approach in the mathematics of geometry on the aspect of mathematical problem solving and the students' behaviours toward mathematics. From the result of further test indicated that: (a) an open-ended approach was more effective than contextual approach on of students' mathematical problem solving, (b) an open-ended approach was not more effective than the contextual approach on student's behaviour of mathematics.

From several of the researches showed that an open-ended approach had an important role on students' mathematics skills. In the research, [14] applying of an open-ended approach in mathematics on students' mathematical representation abilities. An open-ended approach is an approach that gives a problem with lots of completion ways and lots of alternative answer appropriate on style of students' thinking which is an open-ended questions can give freedoms to the students in presenting their ideas and opinions, therefore it can be increased the capability of students' mathematical representation [15], (1) learning mathematics by using an

open-ended approach and contextual were effective on aspect of problem solving capability and the students' behaviour toward mathematics. (2) open-ended approach was more effective on aspect of problem solving ability; open-ended approach wasn't more effective than contextual approach on aspect of students' behavior in mathematics. [16] Observation of the first lesson showed that the communication in the classroom was mostly focused on the teacher, which provided little student-student and student-class interaction. In the second observed lesson, the teacher changed the attention she paid to what each student said and did, encouraging the students to ask each other and encouraged student-class and the student-student communication. [17] Open-ended tasks had a positive effect on improving students' mathematics achievement, and assessing their perspectives toward using the tasks in learning mathematics. [18] The result of the research generally showed that the MCTA improvement and SE achievement of the students' who were taught by an open-ended learning were better than the usual learning or the conventional learning. It was also presented about the MCTA improvement and SE achievement of the students' reviewed from every category of school.

Based on the literature, to ensure the success of students' mathematical skills, the teacher could use the goal of an open-ended learning where the students were developing creative activities and the skills to think mathematically. Therefore, the main purpose of this research was to develop, to improve, and to strengthen the learning of an open-ended approach in mathematics at grade of elementary school Padangsidimpunan.

4. Conclusions and Suggestions

4.1 Conclusions

Based on the research result and the discussion, the average of post test was better than pretest. Where the average of pretest was 51.08 and the average of posttest was 78.78. Likewise, the result of the test "t" was obtained $t_{count} > t_{table} = 11.67 > 2.042$ with a significant level 5% (0.05) and $df = (N-1) = (31 - 1) = 30$.

So, the researcher could be concluded that there was a significant effect of an open-ended approach on the students' creativity in fractional material at grade III SD Negeri 200117 North Padangsidimpunan.

4.2 Suggestions

Based on the research results that has been conducted by the researcher and the given conclusions, then the researcher's suggestions are:

1. For the teachers, it's suggested to apply an open-ended approach on students' learning creativity in order to support the learning process so that their learning outcomes can be increased well, and expected to adjust the applied approach with the taught material.
2. For the students, it's suggested to be more active in learning process and to participate actively in every process, even if the teacher gives an opened problem. It will be useful to develop the students' creative thinking skills.
3. For the headmaster, should often provide information/coaching to the teachers in the field of study in order to develop the way of teaching.

4. To the next researchers, it is expected to conduct more in-depth research on open-ended approach to be more creative.

5. Limitations

The limitations in this research are as follows:

- This research is limited to students of class III-C SDN 200117 North Padangsidempuan in the academic year 2014-2015.
- This research was conducted during the learning activity of mathematics on the subject of Fractions.
- The approach used is Open-Ended (OE) and limited to the ability of students' mathematical creativity.

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